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Though diminishing as the fatigue comes on, it may in certain persons persist to a certain amount even after the fatigued muscle ceases to respond to stimuli. A very short rest is sufficient to restore the contractur. The intensity of the contractur is in relation to the intensity of the electric excitation up to a certain maximum. It is less marked with voluntary contractions than with those produced by electric excitation. It is only well marked with light weights. The adding of a heavy weight for a time, may be followed on return to a light weight by the contractur. Contractur is entirely a muscular phenomenon in spite of the fact that it is seen more marked in persons in an irritable condition. Indeed in experiments on animals it may be observed on curarized muscles. This observation is important as showing that many phenomena accompanying exaggerated excitability are of peripheral origin and independent of the central nervous system. The contractur seems never to occur in certain muscles as of the eyes, and in other muscles only to accompany excessive effort. It seems to be almost an abnormal condition, a symptom characteristic of an alteration of the muscle produced by too great excitation, and hence as a form of fatigue manifested in the muscle as it passes from a state of rest to that of work. It is probable that the first contractions of a fresh muscle differ from those of a fatigued muscle. Maggiora shows that a fatigued muscle is injured more by work than a fresh muscle. The shape of the muscle curve is influenced, not only by the contractur, but by the elasticity of the muscle and many other factors, so that its interpretation is most difficult. Mosso promises another paper on this subject. In spite of apparent contradictions he looks upon the contractur as a phenomenon of fatigue. It is certain that the nervous excitation produces in the muscle other effects than contraction. One recalls Bowditch's "Treppe." Mosso regards the "Treppe" as due to fatigue. It can be prevented by massage, and he thinks it ceases because the muscle by its contractions massages itself. The relation of these questions to the theory of tetanus is most important and it is to be hoped that Prof. Mosso will continue his work in this direction.

*Effect of fatigue on elasticity of muscles.* In some experiments the elasticity seems diminished by fatigue, in others the results are masked by the continuance of the contractur. The confusion of terminology—contractur, tonicity, elasticity, makes a clear understanding and statement of results a matter of great difficulty.

*The influence of a support on the height of the contraction.* The curve of fatigue is uninfluenced by having the weight supported at various heights during the work when the muscle is fresh, but if it be weary the partial removal of the weight increases the height of the contraction, i. e., when fresh, the muscle gives a maximal contraction regardless of the weight, but when weary it is aided if the weight be supported at a certain height.

W. F. L.

*Ueber die kleinsten wahrnehmbaren Gesichtswinkel in den verschiedenen Theilen des Spektrums.* W. UHTHOFF. Zeitsch. f. Psychol. Bd. I, H. 3. 1890.

In connection with his studies on the acuteness of vision, Uhthoff has re-determined the smallest angular distance by which two objects must be separated in order to be seen separately, when illuminated with light of different colors. The importance of his determination rests on his having used spectral lights. The visual object was a fine wire net specially made for the purpose in which the intervals between the wires were just equal to the diameter of the wires, i. e., 0.0463 mm. This was seen against the face of a large prism so fixed that its whole surface was presented to the observer illuminated with one monochromatic light. The wire-net was moved backward and forward between the

eye and the prism till its wires reached the limit of separate visibility. The intensity of the light was made so great that no increase of intensity caused an increase in the visibility of the wires. Wave lengths 670, 605, 575, 535, 505, 470, 430  $\mu\mu$ , corresponding to the seven spectral colors were used. The experiments show that the *color* of the light has scarcely any influence provided that the *intensity* is sufficient. The limit was reached for one observer when a wire subtended an angle of about 32."8, for the other 27."6, corresponding respectively to retinal images of 0.00234 mm., and 0.002 mm. The value generally assigned for this angle is 1' and these experiments, when the measurement is made in the same way, i. e. from the middle of one wire to the middle of the next, give substantially the same result, namely: for one observer 65."6, for the other 55."2.

*Ueber die Muskuläre Reaction und die Aufmerksamkeit.* GÖTZ MARTIUS. Philos. Stud. Bd. VI, H. 2.

The question here discussed is the significance of the important distinction between "sensory" and "motor" forms of reaction as introduced by Lange. The distinction itself Martius fully corroborates, finding it somewhat small in practiced reactors (about 20 $\sigma$ ), but marked in two novices (about 100 $\sigma$ .) He, however, agrees with Wundt that the distinction is confined to simple reactions, and questions the validity of Münsterberg's extension of this distinction to more complicated reactions. He has repeated Münsterberg's experiments of reacting with the five and with the ten fingers to the first five and first ten numbers, the reaction to five vocal sounds, to five different declensional forms, to five categories such as a "river," "a city," etc., and finds in all these cases where Münsterberg found a large and increasing difference between the "sensory" and "motor" reactions, only a slight difference; and while Münsterberg finds the "sensory" longer than the "motor," Martius has a flatly contradictory result. While unable to explain Münsterberg's results, he feels confident that no true distinction between motor and sensory was there involved, and that it is impossible to apply this distinction beyond the simple reaction. The second portion of the study describes simple reactions in which the subject, after each reaction, gave a judgment as to its comparative worth, and also described his attitude of mind at the moment of reacting. This very commendable method is not carried forth with sufficient system to allow of easy formulatable conclusions, but they leave in Martius's mind an increased confidence in the value of his results. A third point discussed at length is the mechanism by which the shortening process of the motor reaction takes place. In opposition to the view that it is a return to a reflex mode of action—a view which he treats too literally—he holds that the motor reaction anticipates and takes for granted the precise nature of the stimulus and therefore reacts to it at an earlier stage of its development.

The most essential and puzzling contribution of this paper is the opposition to Münsterberg's results; only careful and abundant research can explain this important point. J. J.

*Untersuchungen zur Mechanik der activen Aufmerksamkeit.* GEORG DWELSHAUVERS. Philos. Stud. Bd. VI, H. 2.

The author has determined anew the effect of a signal preceding the stimulus in reactions, with due reference to the distinction between "sensory" and "motor" reactions. He finds that reactions to the fall of a hammer preceded by a signal at an interval of 1½ seconds, were executed in 257 $\sigma$  sensory and 130 $\sigma$  motor; if the interval was 3 seconds, the times were 280 $\sigma$  and 133 $\sigma$ ; if 6 seconds, 300 $\sigma$  and 149 $\sigma$ , (average of 5 subjects). On the other hand, when no signal preceded, the "sensory"